Agency for Healthcare Research and Quality
Advancing Excellence in Health Care

NATIONAL GUIDELINE CLEARINGHOUSE

General

Guideline Title

Management of pulmonary contusion and flail chest: an Eastern Association for the Surgery of Trauma practice management guideline.

Bibliographic Source(s)

Simon B, Ebert J, Bokhari F, Capella J, Emhoff T, Hayward T 3rd, Rodriguez A, Smith L, Eastern Association for the Surgery of Trauma. Management of pulmonary contusion and flail chest: an Eastern Association for the Surgery of Trauma practice management guideline. J Trauma Acute Care Surg. 2012 Nov;73(5 Suppl 4):S351-61. [134 references] PubMed

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Simon B, Ebert J, Bokhari F, Capella J, Emhoff T, Hayward T III, Rodriguez A, Smith L. Practice management guideline for "pulmonary contusion - flail chest". Charleston (SC): Eastern Association for the Surgery of Trauma (EAST); 2006 Jun. 74 p. [100 references]

Recommendations

Major Recommendations

The levels of recommendation (1-3) and classification of evidence (I-III) are defined at the end of the "Major Recommendations" field.

Level 1

There is no support for Level 1 recommendations regarding pulmonary contusion and flail chest (PC-FC).

Level 2

Trauma patients with PC-FC should not be excessively fluid restricted but rather should be resuscitated as necessary with isotonic crystalloid or colloid solution to maintain signs of adequate tissue perfusion. Once adequately resuscitated, unnecessary fluid administration should be meticulously avoided.

1. A pulmonary artery catheter *may* be useful to avoid fluid overload during resuscitation.
2. Obligatory mechanical ventilation in the absence of respiratory failure solely for the purpose of overcoming chest wall instability should be avoided.
3. Patients with PC-FC requiring mechanical ventilation should be supported in a manner based on institutional and physician preference and separated from the ventilator at the earliest possible time. Positive end-expiratory pressure (PEEP)/continuous positive airway pressure

(CPAP) should be included in the ventilatory regimen.
4. The use of optimal analgesia and aggressive chest physiotherapy should be applied to minimize the likelihood of respiratory failure and ensuing ventilatory support. Epidural catheter is the preferred mode of analgesia delivery in severe FC injury (see the Eastern Association for the Surgery of Trauma [EAST] guidelines: Pain management guidelines for blunt thoracic trauma).
5. Steroids should not be used in the therapy of PC.

Level 3

1. A trial of mask CPAP should be considered in alert, compliant patients with marginal respiratory status in combination with optimal regional anesthesia.
2. There is insufficient evidence to prove the effectiveness of paravertebral analgesia in the trauma population. However, this modality may be equivalent to epidural analgesia and may be considered in certain situations when epidural is contraindicated.
3. Independent lung ventilation may be considered in severe unilateral PC when shunt cannot be otherwise corrected owing to maldistribution of ventilation or when crossover bleeding is problematic.
4. High-frequency oscillatory ventilation (HFOV) has not been shown to improve survival in blunt chest trauma patients with PC but has been shown to improve oxygenation in certain cases when other modalities have failed. HFOV should be considered for patients failing conventional ventilatory modes. The appropriate triggers for institution of HFOV have not been defined.
5. Diuretics may be used in the setting of hydrostatic fluid overload as evidenced by elevated pulmonary capillary wedge pressures in hemodynamically stable patients or in the setting of known concurrent congestive heart failure.
6. Although improvement has not been definitively shown in any outcome parameter after surgical fixation of FC, this modality may be considered in cases of severe FC failing to wean from the ventilator or when thoracotomy is required for other reasons. The patient subgroup that would benefit from early "prophylactic" fracture fixation has not been identified.
7. There is insufficient clinical evidence to recommend any type of proprietary implant for surgical fixation of rib fractures. However, in vitro studies indicate that rib plating or wrapping devices are likely superior to intramedullary wires and these should be used as the preferred fixation device.
8. Self-activating multidisciplinary protocols for the treatment of chest wall injuries may improve outcome and should be considered where feasible.

Definitions:

Classes of Evidence

Class I: Prospective randomized clinical trials.

Class II: Clinical studies in which data were collected prospectively or retrospective analyses based on clearly reliable data.

Class III: Studies based on retrospectively collected data.

Levels of Recommendation

Level 1: The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on Class I data, however, strong Class II evidence may form the basis for a Level I recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low quality or contradictory Class I data may not be able to support a Level I recommendation.

Level 2: The recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. This recommendation is usually supported by Class II data or a preponderance of Class III evidence.

Level 3: The recommendation is supported by available data but adequate scientific evidence is lacking. This recommendation is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future clinical research.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Pulmonary contusion/flail chest (PC/FC)

Guideline Category

Management

Treatment

Clinical Specialty

Critical Care

Emergency Medicine

Pulmonary Medicine

Thoracic Surgery

Intended Users

Advanced Practice Nurses

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

- To present updated evidence-based recommendations for the treatment of pulmonary contusion and flail chest (PC-FC)
- To revise and expand on the Eastern Association for the Surgery of Trauma (EAST) 2006 recommendations

Target Population

Trauma patients with pulmonary contusion/flail chest (PC/FC)

Interventions and Practices Considered

Management

1. Fluid management
    - Resuscitation with isotonic crystalloid or colloid solution
    - Pulmonary artery catheterization to avoid fluid overload
    - Diuretics in the setting of hydrostatic fluid overload
2. Modes of ventilatory support
    - Mechanical ventilation as indicated
    - Positive end-expiratory pressure (PEEP)/continuous positive airway pressure (CPAP)
    - Analgesia (by epidural catheter) and chest physiotherapy
    - Consideration of other ventilatory supports (e.g., mask of CPAP, paravertebral analgesia, independent lung ventilation, high-frequency oscillatory ventilation [HFOV])
3. Surgical repair of flail chest/rib fractures

4. Other miscellaneous therapies

Major Outcomes Considered

- Rates of morbidity, mortality, and survival
- Length of ventilator dependence and hospital stay
- Complications of treatment
- Long term disability
- Other measures such as central nervous system trauma, pulmonary failure, brain injury and shock

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

For the original 2006 guideline, a computerized search was conducted of the MEDLINE, Embase, PubMed and Cochrane databases for North American and European English-language literature for the period from 1966 through June 30, 2005. The initial search terms were *pulmonary contusion*, *flail chest*, *rib fractures*, *chest injuries*, and *thoracic injuries*. This search initially yielded 91 articles. An additional 39 works were obtained from the references of these studies yielding a total of 130 articles. Thirty-eight of these articles were excluded as being case studies, reviews, letters, or otherwise irrelevant to the questions being asked. The remaining 92 studies were reviewed, graded, and listed in the evidentiary table.

For the 2011 update of the guideline, a similar search was performed from July 1, 2005 through June 30, 2011. In this case, 85 articles were initially identified yielding 37 studies appropriate for grading by the same criteria.

Number of Source Documents

92 studies from the original guideline and 37 additional studies in the update

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Class I: Prospective randomized clinical trials.

Class II: Clinical studies in which data were collected prospectively or retrospective analyses based on clearly reliable data.

Class III: Studies based on retrospectively collected data.

Methods Used to Analyze the Evidence

Systematic Review

Description of the Methods Used to Analyze the Evidence

All studies were reviewed by two committee members and graded according to the standards recommended by the Eastern Association for the Surgery of Trauma (EAST) Ad Hoc Committee for Guideline Development and described in the EAST "Utilizing evidence based outcome measures to develop practice management guidelines: a primer" (see the " Availability of Companion Documents" field). Grade I evidence was also subgraded for quality of design using the Jadad Validity Scale published in Controlled Clinical Trials in 1996. Any studies with conflicting grading were reviewed by the committee chairperson, as were all Grade I studies.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The practice parameter workgroup for pulmonary contusion and flail chest (PC-FC) consisted of eight trauma surgeons, three of whom were also trained and certified as thoracic surgeons. Recommendations were formulated based on a committee consensus regarding the preponderance and quality of evidence.

Recommendations were classified as level 1, 2, or 3 according to the definitions listed in the "Rating Scheme for the Strength of the Recommendations" field.

Rating Scheme for the Strength of the Recommendations

Level 1: The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on Class I data, however, strong Class II evidence may form the basis for a Level I recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low quality or contradictory Class I data may not be able to support a Level I recommendation.

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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate management of pulmonary contusion/flail chest (PC/FC)

Potential Harms

Complications related to management/treatment measures

Contraindications

Contraindications

- Paravertebral analgesia may be equivalent to epidural analgesia and may be appropriate in certain situations when epidural is contraindicated
- Obligatory mechanical ventilation in the absence of respiratory failure should be avoided

Qualifying Statements

Qualifying Statements

- The Eastern Association for the Surgery of Trauma (EAST) is a multi-disciplinary professional society committed to improving the care of injured patients. The Ad hoc Committee for Practice Management Guideline Development of EAST develops and disseminates evidence-based information to increase the scientific knowledge needed to enhance patient and clinical decision-making, improve health care quality, and promote efficiency in the organization of public and private systems of health care delivery. Unless specifically stated otherwise, the opinions expressed and statements made in this publication reflect the authors' personal observations and do not imply endorsement by nor official policy of the Eastern Association for the Surgery of Trauma.
- "Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances."* These guidelines are not fixed protocols that must be followed, but are intended for health care professionals and providers to consider. While they identify and describe generally recommended courses of intervention, they are not presented as a substitute for the advice of a physician or other knowledgeable health care professional or provider. Individual patients may require different treatments from those specified in a given guideline. Guidelines are not entirely inclusive or exclusive of all methods of reasonable care that can obtain/produce the same results. While guidelines can be written that take into account variations in clinical settings, resources, or common patient characteristics, they cannot address the unique needs of each patient nor the combination of resources available to a particular community or health care professional or provider. Deviations from clinical practice guidelines may be justified by individual circumstances. Thus, guidelines must be applied based on individual patient needs using professional judgment.

*Institute of Medicine. Clinical practice guidelines: directions for a new program. MJ Field and KN Lohr (eds) Washington, DC: National Academy Press. 1990: pg 39.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2006 Jun (revised 2012 Nov)

Guideline Developer(s)

Eastern Association for the Surgery of Trauma - Professional Association

Source(s) of Funding

Eastern Association for the Surgery of Trauma (EAST)

Guideline Committee

Eastern Association for the Surgery of Trauma (EAST) Practice Parameter Workgroup for Pulmonary Contusion-Flail Chest

Composition of Group That Authored the Guideline

Authors: Bruce Simon, MD, James Ebert, MD; Faran Bokhari, MD; Jeannette Capella, MD; Timothy Emhoff, MD; Thomas Hayward, III, MD; Aurelio Rodriguez, MD; Lou Smith, MD

Financial Disclosures/Conflicts of Interest

The authors declare no conflicts of interest.

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Guideline Availability

Electronic copies: Available from the Eastern Association for the Surgery of Trauma (EAST) Web site .

Print copies: Available from the Eastern Association for the Surgery of Trauma Guidelines, c/o Bruce J Simon, MD, UMass Memorial Medical Center, Worcester, MA.

Availability of Companion Documents

The following is available:

- Utilizing evidence based outcome measures to develop practice management guidelines: a primer. 2000. 18 p. Available in Portable Document Format (PDF) from the Eastern Association for the Surgery of Trauma (EAST) Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on January 9, 2007. The information was verified by the guideline developer on February 26, 2007. This NGC summary was updated by ECRI Institute on May 9, 2013.

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